

## Thermal Power Sensor Head with Background Compensation



**S401C**

### Description

The compact S401C Thermal Power Sensor Head is designed to provide high resolution and low-drift measurements and fast response times. The high-sensitivity thermal sensor enables power measurements from 10  $\mu\text{W}$  to 1 W in free-space and fiber-based applications. Thermal background compensation is performed by monitoring the heat flow from the housing in addition to the heat flow from the sensor element; subtracting the two mitigates the influence of the ambient temperature on the power measurement. The S401C housing includes a removable threaded adapter aligned with the axis of the light input aperture that is compatible with any number of Thorlabs' SM1-threaded (1.035"-40) accessories. This allows convenient mounting of external optics, fiber adapters, light shields, and apertures. Two 8-32 & M4-threaded mounting holes are provided to accommodate posts and post holders.

When operating the sensor, allow it to settle to room temperature and afterwards perform a zero adjustment. Although the sensor will correct for ambient temperature changes, we recommend operating the sensor head post mounted, rather than handheld, as thermal contributions from body heat can negatively impact the accuracy of the measurement. The active detector area should also be protected from air flow and other thermal disturbances. The S401C is compatible with all currently-available Thorlabs power meter consoles. The EEPROM built into the connector contains sensor identification information and the NIST- and PTB-traceable calibration data, which is used by the consoles.

### Specifications

S401C	
Detector Type	Thermal Surface Absorber with Background Compensation
Wavelength Range	190 nm - 20 $\mu\text{m}$
Optical Power Working Range	10 $\mu\text{W}$ - 1 W (3 W Max for Exposure Times $\leq 20$ minutes)
Max Average Power Density	500 W/cm <sup>2</sup>
Max Pulse Energy Density	0.2 J/cm <sup>2</sup> (1 $\mu\text{s}$ Pulse), 2 J/cm <sup>2</sup> (1 ms Pulse)
Resolution <sup>a</sup>	1 $\mu\text{W}$
Linearity	$\pm 0.5\%$
Measurement Uncertainty <sup>b</sup>	$\pm 3\%$ @ 1064 nm; $\pm 5\%$ @ 190 nm - 10.6 $\mu\text{m}$
Response Time <sup>c</sup>	1.1 s
Input Aperture	$\varnothing 10$ mm
Active Detector Area	10 mm x 10 mm
Active Area Uniformity	$\pm 1\%$ (>1 mm Beam Diameter)
Sensor Dimensions	43 mm x 33 mm x 15 mm (1.69" x 1.3" x 0.58")
Typical Applications (Laser Types)	Low Power Lasers (Diode, Diode Arrays, HeNe, Dye, Ion Lasers (Ar <sup>+</sup> , Kr <sup>+</sup> ))
Coating / Diffuser	Broadband
Cooling	Convection
Thorlabs Console Compatibility (Available Separately)	PM100D, PM100USB, PM100A, PM200, PM400, PM320E

a. Measured using the PM200 console with the acceleration circuit switched off. Resolution performance will be similar with Thorlabs' other power meter consoles.

b. Measurement uncertainty during calibration at the specified wavelengths for a beam diameter > 1 mm. The  $\pm 3\%$  specification was determined by laser calibration, and the  $\pm 5\%$  specification was determined through spectral calibration, in which values were interpolated using the laser calibration data and the absorption curve for the absorber.

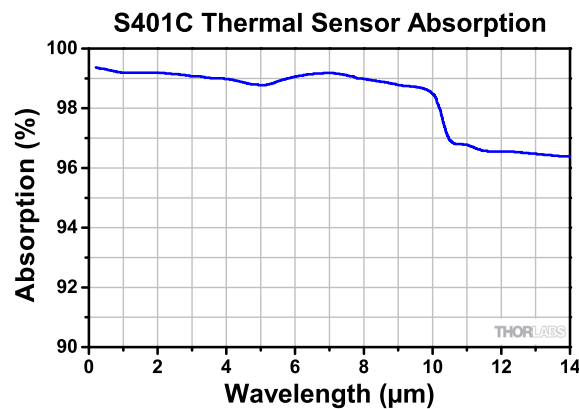
c. Typical Natural Response Time (0 - 95%)

## Specifications (Continued)

S401C	
Cable Length	1.5 m
Connector	D-Sub-9 Pin Male
Weight	0.05 kg
Threaded Holes	8-32 (M4), Two Places
Through Holes	Ø6 mm (0.24") <sup>b</sup>
Aperture Threading	SM05 (0.535"-40) Internal
Adapter Threading	SM05 (0.535"-40) External, SM1 (1.035"-40) External
Adapter Fasteners	M2.5 x 4 Countersunk Screws (2 Places)
Light Shield	29.4 mm (1.16") Long, SM1 (1.035"-40) Internal Threading

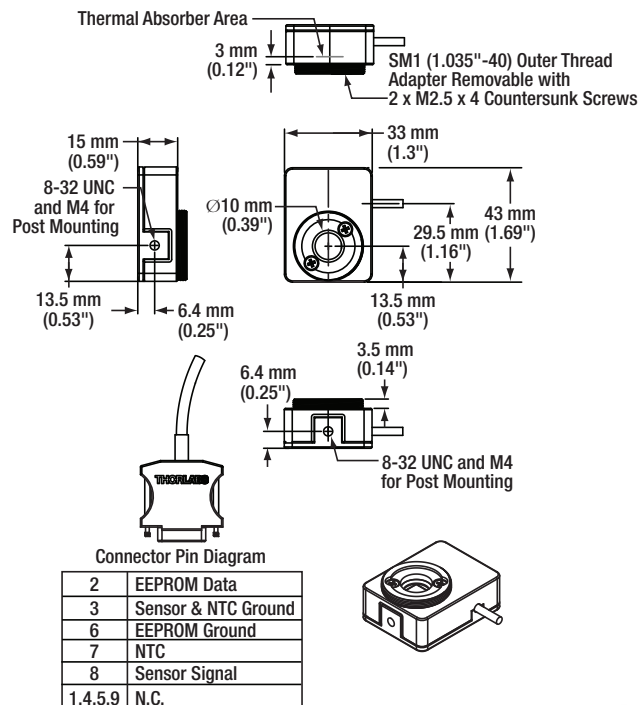
a. Designed to be compatible with Thorlabs' 30 mm cage system components.

b. Designed to accommodate ER series rods.



Typical absorbance of the S401C's broadband coating. There is negligible back reflection from the coating.

## Mechanical Drawing



## Cleaning and Maintenance

There are no serviceable parts in the S401C head. The housing may be cleaned by wiping with a soft damp cloth. Do not touch or wipe the absorber surface or use any solvents to clean it! Gently blow off any debris using compressed air. If you suspect a problem with your S401C, please call Thorlabs and an engineer will be happy to assist you.

As long as the sensor has not been exposed to excessive optical power (please pay attention to the maximum ratings in the technical specifications), the calibration should be very stable over long periods of time (well over a year). To maintain the accuracy and performance of the S401C, Thorlabs recommends a yearly recalibration, starting one year after purchase.

## Precautions and Warranty Information

These products are ESD (electro static discharge) sensitive and as a result are not covered under warranty. Any applied voltage in excess of the maximum specification will cause damage and possible complete failure to the product. The user must use handling procedures that prevent any electrostatic discharges or other voltage surges when handling or using these devices.

The user must avoid any misuse that could cause damage to the detector. Misuse includes, but is not limited to, laser exposure outside Thorlabs' published specifications, high voltage exposure outside Thorlabs' specifications, physical damage due to improper handling and exposure to harsh environments. Harsh environments include, but are not limited to, excessive temperature, vibration, humidity, chemicals or surface contaminants, exposure to flame, aggressive solvents and connection to improper electrical voltage.

Thorlabs, Inc. Life Support and Military Use Application Policy is stated below:

THORLABS' PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS OR IN ANY MILITARY APPLICATION WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF THORLABS, INC. As used herein:

- 1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.*
- 2. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system or to affect its safety or effectiveness.*
- 3. The Thorlabs products described in this document are not intended nor warranted for usage in Military Applications.*



**Manufactured By:**

Thorlabs GmbH, D-85221 Dachau, Hans-Boeckler-Str. 6

January 9, 2018

MTN003328-S01, Rev B